EPA's Cleaner Technologies Substitutes Assessment for the Dry Cleaning Industry: A Real World Industrial Ecology Example

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I'd like to add an industrial ecology perspective before I get into a discussion of the Cleaner Technology Substitutes Assessment (CTSA). What I want to share with you is this graph (slide 2). It's from the President's Council on Sustainable Development and it lays out a 50-year strategic plan for technology development at the end of the 20th century and the first part of the 21st century. What it shows are four lines, one each for remediation and restoration, control, monitoring and assessment, and avoidance or pollution prevention. The point is that at the end of the 20th century, we're spending a lot of effort and monies on remediation, restoration, and control. The long-term strategic plan, however, is to have pollution prevention be the paradigm in order to avoid having to expend major effort on remediation and restoration or, for that matter, on control. If you don't create the pollution in the first place, then you don't have the cost of cleaning it up, controlling it, or the liabilities associated with it.

The Dry Cleaning Project is an excellent illustration of industrial ecology because, although it started out dealing with the issue of environmental and worker exposures to perchloroethylene (perc), we now have new technologies that are coming forward and we've even changed the people that are participating in the process. It's not only the small "mom and pop" dry cleaners, the franchise people, or the hardware and the solvents people who are involved in this, but also we're now talking to the people who actually produce the garments themselves and to the people who produce the textile fibers from which the garments are made. This is part of the ecological web notion here in an industrial setting. We are trying to influence the chemistry of the polymers and the surface finishes used in and on the garments in order to make them more amenable to pollution prevention technologies for the fabric care industry. I think that is pretty exciting.

Just to quickly reiterate the Design for Environment (DfE) vision, it's the simple notion of taking classical cost and performance parameters as a basis for decision-making and including an environmental component. The mission of our program is to use the Office of Pollution Prevention and Toxics (OPPT) risks management expertise to help inform business decisions to affect behavioral change. As Bill Sanders, the Director of OPPT, has indicated in his remarks, one of the hallmarks of the DfE program is that it is a voluntary program involving partnerships to empower the participants to move forward toward pollution prevention. Ohad Jehassi has indicated that the stakeholders in the Dry Cleaning Project include not only the U.S. Environmental Protection Agency (EPA) and industry, but also the public sector and environmental and labor groups as well.

Which brings me to what I have been charged with, to provide you with a thumbnail sketch of what a CTSA is all about. A CTSA is a systematic comparison of the performance cost and human health and environmental risks associated with chemicals, processes, and technologies. The goal is to evaluate the traditional as well as the alternative technologies, to evaluate substitutes, and to evaluate control options.

The idea is to lay out the tradeoffs among the options in order to facilitate informed decisions. It turns out that if you look at what is required to go into a CTSA, you create a rather daunting matrix of modules. They include basic chemical information, human health and hazard summaries, the environmental hazard summaries, and the market information process description. The modules also include exposure issues that get compiled into a risk assessment including safety and process hazard issues, evaluation of the P2 options, and some ancillary information on the regulatory status and performance and social costs and benefits. Completing this matrix is a rather formidable task. In this particular case where we are looking at substitute technologies, we take all of those module elements and array them for the various substitute technologies in a data matrix.

In the case of the dry cleaning technology assessment, we've been charged with taking the existing technologies and some newly available ones to fill in the matrix that I've just presented. The more challenging aspect is to also get a handle on those technologies under development and for which the data base is extremely limited. These new technologies include efforts to deal with petroleum solvents, various fluorocarbons, and liquid carbon dioxide. What's unique or exciting, for me at least, is the emergence by virtue of this process here in the United States of us giving serious consideration to substitutes for traditional dry cleaning. We've been working on the wet cleaning processes with our colleagues here in the United States and in Canada, and we've had more recent efforts with the people in Europe such as in Germany. Again, the challenge is to pull together the information which, in many cases, is somewhat limited because the technologies are fairly new.

What Lynn Blake-Hedges, the CTSA Project Manager, and the Dry Cleaning Work Group at EPA are doing is assembling a table that looks something like this. It takes all of the modules I showed in the previous graphic (slide) and fills in the boxes to make a comparison across the technologies. The objective of the comparison is *not* to dictate what technology to choose. The objective is to provide the information so that informed decisions can be made. A decision one individual might make may differ from another individual, depending on their particular circumstances such as the capital investment they're confronted with, and whether they've recently made investments in a particular technology or not.

Once the CTSA is completed, the challenge is to communicate it to the industry and to consumers. Lynn Blake-Hedges and the Work Group are working diligently to integrate Phase I, which is the CTSA for the perchloroethylene (perc) and petroleum solvents. The Phase II document covers all of the other technologies listed in the matrix. The timetable is to complete that process by the end of the year. This particular document has to go into peer review, and we look for that to happen this winter. We're optimistic we will release the integrated Phase I and Phase II CTSA sometime in late spring of 1997. For those of you that have been involved in the process, you know there has been some difference of opinion associated with the CTSA, particularly in the area of risk characterization. We continue to work with Bill Sanders and Lynn Blake-Hedges to come up with an appropriate presentation of the risk characterization, in order to meet our objectives.

I must tell you, as someone who has been at EPA since 1977, the DfE Program and particularly the fabric care project (I find myself no longer using the word "dry cleaning" because I think we've gone beyond that to include other processes) is one of the most exciting things that I've been involved in professionally. We're really making a change in the way people do business. We are now starting to impact the garment industry, and ultimately we'll be impacting the polymer industry. For us, that comes full circle, because OPPT also has the Green Chemistry program which is trying to come up with environmentally benign ways of doing chemical synthesis. All of a sudden, we have this unusual circumstance of us working with chemists like Professor Joe DeSimone at the University of North Carolina on the Green Chemistry side, who runs polymer reactions in environmentally benign solvents such as liquid carbon dioxide. That information has implications for developing chemicals, such as surfactants and finishes, that will be used in the fabric care industry particularly the use of liquid CO_2 as a fabric cleaning solvent. It's a marvelous example of industrial ecology at work.

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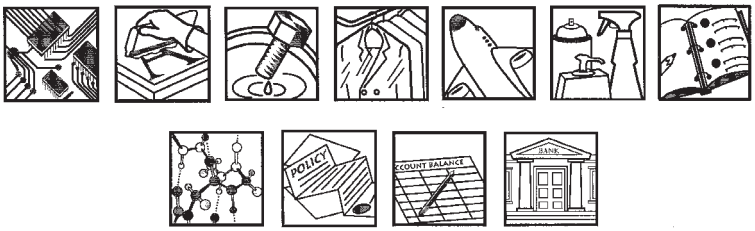
Design for the Environment
EPA

Design for the Environment

Partnerships for a Cleaner Future



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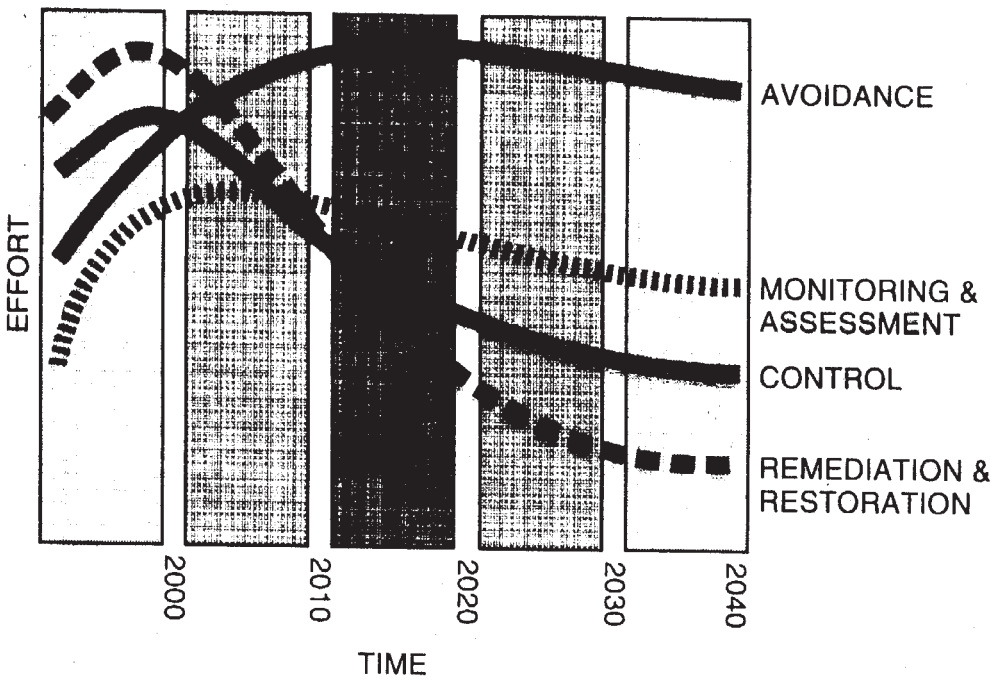
Industrial Ecology: Technology Development



Stephen M. Edgington, "Industrial Ecology. Biotech's Role in Sustainable Development." *Bio/Technology*, Vol. 13, p. 31.

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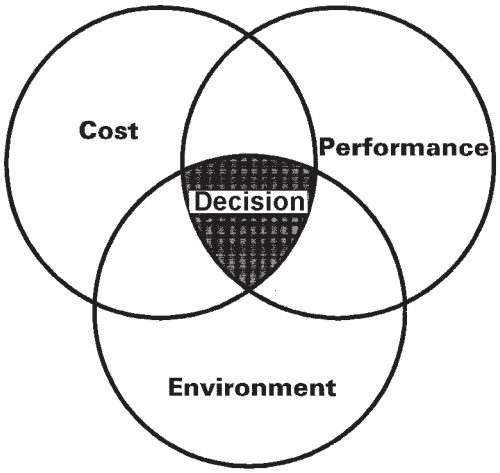
DfE Vision:

- **Business decision-makers integrate environmental concerns into cost and performance criteria**



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DfE Mission:

- **Use the Office of Pollution Prevention and Toxics' risk management methodology to inform business decisions**

Information + Incentives = Behavior Change

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What Is a Cleaner Technology Substitutes Assessment (CTSA)

- **A systematic comparison of the**
  - Performance
  - Cost
  - Human health and environmental risk

  associated with chemicals, processes, and technologies

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Goal of the CTSA:

- **To evaluate**
  - Traditional and alternative technologies
  - Substitutes
  - Control options
- **To lay out the trade-offs among the options**
- **to facilitate informed decisions**

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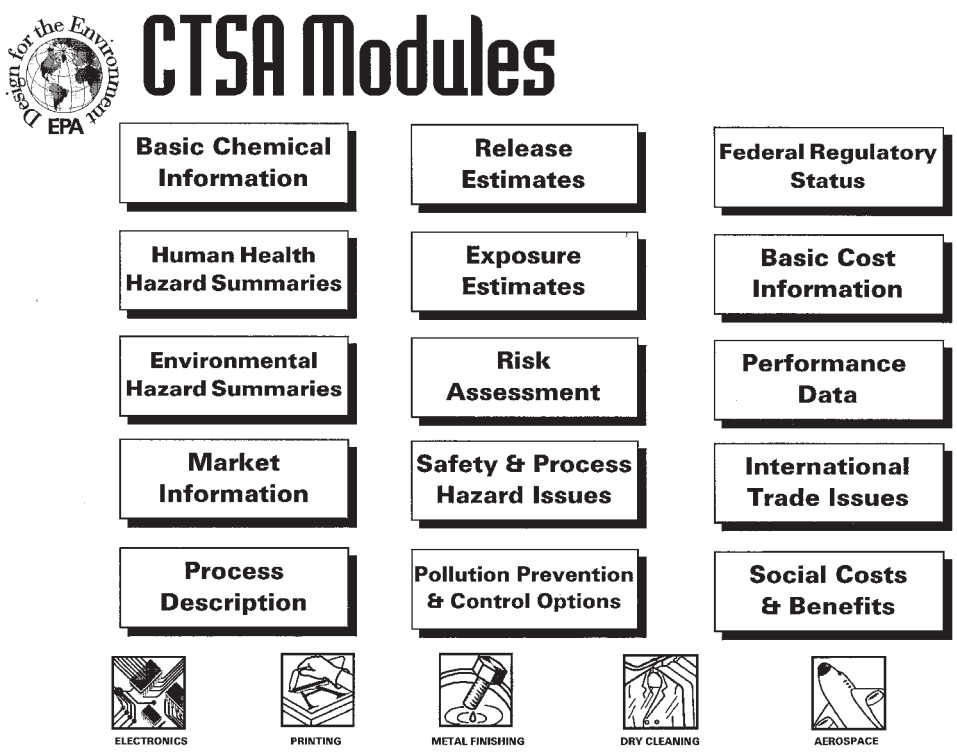
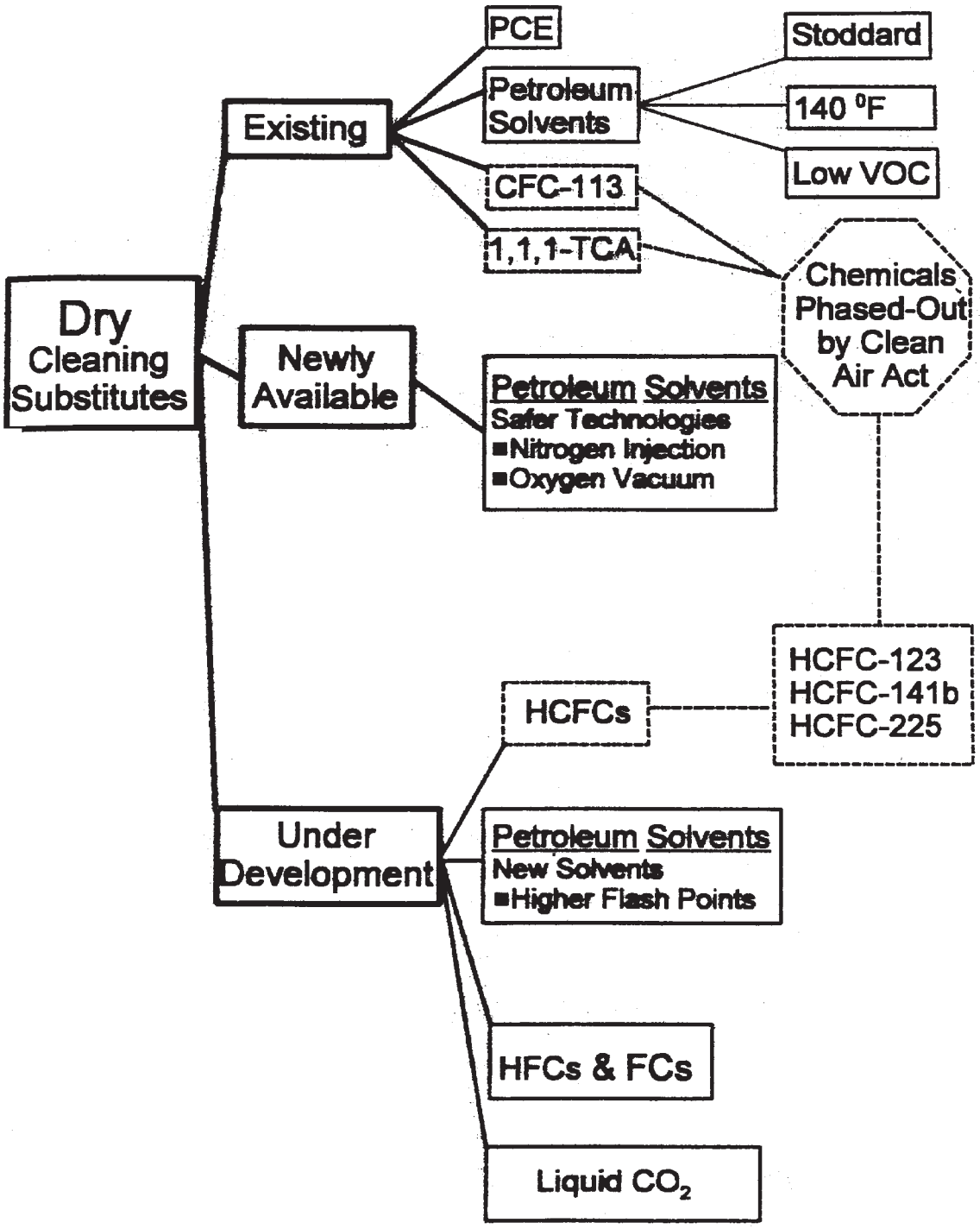

Designed for the Environment
EPA
CTSA Modules
Basic Chemical Information
Release Estimates
Federal Regulatory Status
Human Health Hazard Summaries
Exposure Estimates
Basic Cost Information
Environmental Hazard Summaries
Risk Assessment
Performance Data
Market Information
Safety & Process Hazard Issues
International Trade Issues
Process Description
Pollution Prevention & Control Options
Social Costs & Benefits
ELECTRONICS
PRINTING
METAL FINISHING
DRY CLEANING
AEROSPACE

8

EXISTING AND EMERGING DRY CLEANING ALTERNATIVES



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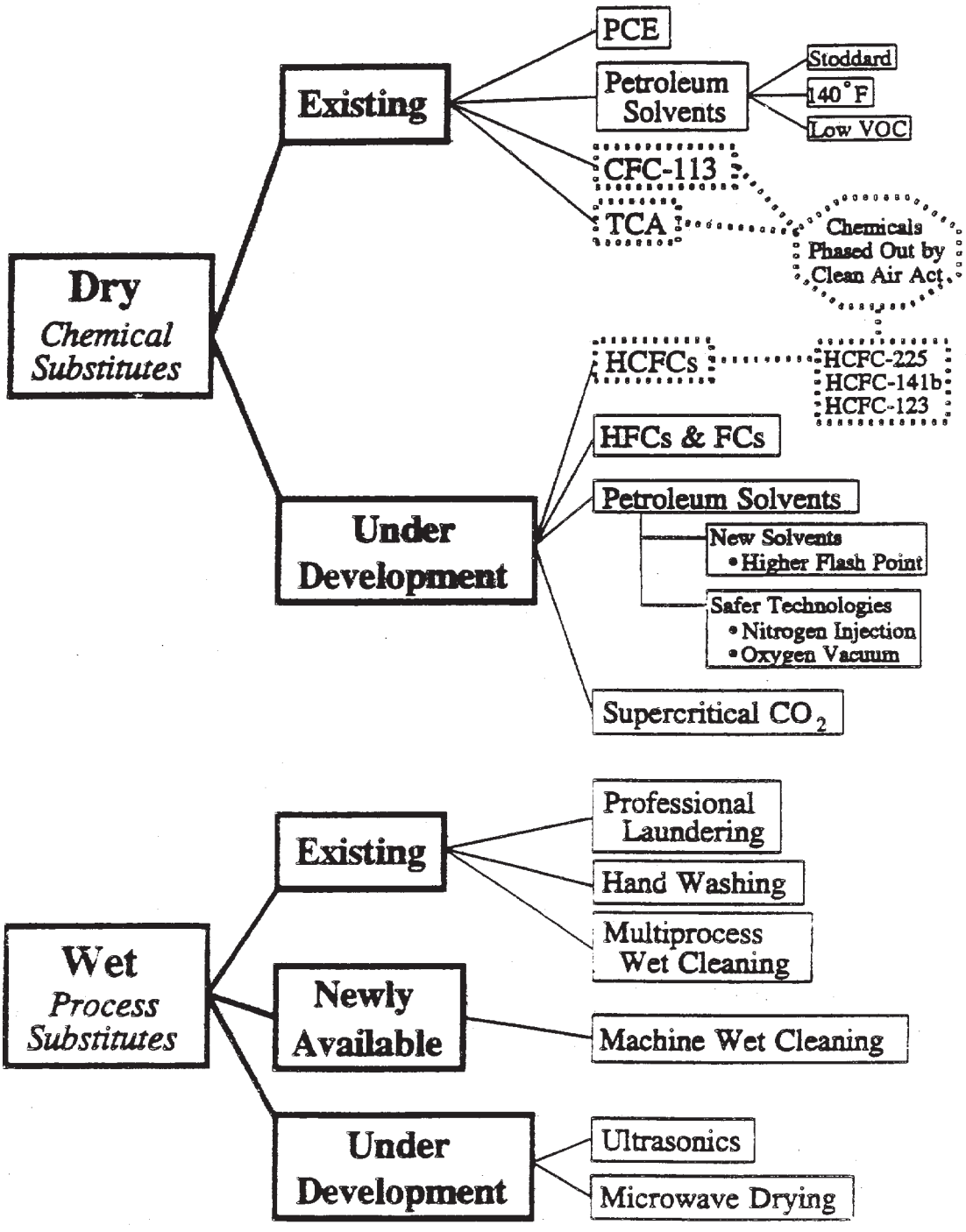
Clothes Cleaning Alternatives



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Alternative Fabricare Technologies Comparison Chart

CHARACTERISTIC	PERC	PS	WET CLEAN	CO_2	MICROWAVE	ULTRASONIC	NEW PS
Chemical Use							
Solvent Use	gal/yr	gal/yr	N/A	gal/yr	N/A		gal/yr
Solvent Mileage	lbs/gal	lbs/gal	N/A	lbs/gal	N/A		lbs/gal
Hazard							
Cancer							
Non-Cancer: Neurotoxicity							
Non-Cancer: Irritant							
Non-Cancer: other							
Environmental							
Flammability							
Human Exposure							
Worker Inhalation							
Worker Dermal							
Adjacent Resident							
Relative Risk							
Cancer							
Non-Cancer							
Environmental							
Costs							
Maintenance Costs	$	$	$	$	$	$	$
Capital Costs	$	$	$	$	$	$	$
Annual Operating Costs	$	$	$	$	$	$	$
Total Annual Costs	$	$ range	$	$	$	$	$
Consumer Issues							
Clothing Applicability							
Odor							
Cleaning Performance							